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10/651,877	08/29/2003	Young-Nam Hwang	5649-1148	9355

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EXAMINER

TRINH, MICHAEL MANH

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 02/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/651,877	Applicant(s) HWANG ET AL.	
	Examiner Michael Trinh	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-19, 22, 23 and 37-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-19, 22, 23, 38, 40, 42 and 44 is/are rejected.
- 7) ☒ Claim(s) 37, 39, 41 and 43 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

*** This office action is in response to Applicant's amendment filed December 08, 2005.

Claims 2-19,22-23,37-44 are pending.

*** The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

1. Claims 38,40,42,44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In dependent claims 38,40,42 and 44: These dependent claims are different from base claims by further including the term "substantially". However, the term "substantially aligned" in claims 38,40,42 and 44 is a relative term which renders the claim indefinite. The term "substantially aligned" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention for "aligned" of base claims 1,6,13, and 22, and for "substantially aligned" of dependent claims 38,40,42, and 44.

Claim Rejections - 35 USC § 102

2. Claims 2-19,22-23,38,40,42,44 are rejected under 35 U.S.C. 102(e) as being anticipated by Casagrande et al (20040012009).

Re base claims 2,3,22, Casagrande teaches a phase-changeable memory cell and method thereof comprising at least: a substrate 11 (Fig 7); forming a bottom electrode 22 on the substrate (Fig 18; paragraphs 57-58); forming a phase changeable material layer pattern 38 on the bottom electrode 22 (Figs 23,25); and forming a top electrode 39,40 on the phase changeable material layer pattern 38, wherein the bottom electrode 22 has a planar portion and a vertical portion (Fig 18,25), wherein, as in other embodiments, first, in the case of marked alignment (Figs 16A-16B, paragraphs 0054-0055), there is just one contact area between the thin portion 38a and the cup shaped regions 22. Accordingly, the top electrode 39,40 (Figures Fig 21-23,25,26A-26B and Figures 16A-16B) has a tip having a center along a length and width that is aligned with a center of a facing surface of the vertical portion of the bottom electrode due to having "just one contact

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area” between the thin portion 38a and the cup shaped region 22. Second, as additionally shown in Figures 25,26A-26B, the top electrode 40 deposited over the portion 38a has a tip that has a center along a length and width that is approximately aligned with a center of a facing surface of the vertical portion of the bottom electrode. Although, as shown in Figures 26A-26B, the portion 38a has a rectangular shape, Casagrande also teaches (at paragraph 0057) that a rectangular shape also comprising the particular case of a square shape. Accordingly, a top electrode deposited on this portion 38a having square shape consequently has a tip that has a center along a length and width that is substantially aligned with a center of a facing surface of the vertical portion of the bottom electrode. Re further claims 2 and 22, the tip of the top electrode extends toward the vertical portion of the bottom electrode 22 (Fig 25,26A-26B; paragraphs 59-66). Re further claim 3, the bottom electrode 22 is cylindrically cup-shaped (paragraph 57; Fig 26A-B), and the vertical portion of the bottom electrode extends from an edge of the planar portion of the bottom electrode 22 (Figs 25, 26A-26B). Re further base claims 6,13, Casagrande teaches a phase-changeable memory cell and method thereof comprising at least: a substrate 11 (Fig 7); forming a bottom electrode 22 on the substrate (Fig 18), wherein the bottom electrode 22 has a planar portion and a vertical portion (Fig 18,25); a middle insulating layer 48,49 on the substrate and the bottom electrode 22, the middle insulating layer defining a contact hole that exposes at least a part of the vertical portion of the bottom electrode 22 (Figs 25,26A,26B; a phase changeable material layer pattern 38 in the contact hole, the phase changeable material layer pattern 38 having a sidewall portion that extends out of the contact hole and across a portion of the middle interlayer insulating layer 48,49 (Figs 23,25); and a top electrode 39,40 on the phase changeable material layer pattern 38, the top electrode 39,40 having a tip that has a center along a length and width that is aligned with a center of a facing surface of the vertical portion of the bottom electrode 22 (Figs 21-23,25,26A-26B for a thin tip portion of the top electrode deposited on a strip 57 and a thin tip portion 38a of the chalcogen layer 38). Re claim 4, wherein the phase changeable material layer 38 pattern is directly on the bottom electrode 22 (Figs 25,26A-26B).

Re claims 5 and 9, wherein the cell further comprises a lower interlayer insulating layer 18 (Figs 5-7, paragraph 42; Fig 25) between the bottom electrode 22 and the substrate 11; and a contact plug 19 extending through the lower interlayer insulating layer 18 and electrically

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connecting the substrate 11 with the bottom electrode 22 (Figs 5-7;25). Re claim 7, wherein a spacer pattern 55a between a sidewall of the contact hole and the phase changeable material layer pattern 38 (Figs 21,23,25; paragraphs 61-62). Re claim 8, wherein the bottom electrode 22 is cylindrical, and the vertical portion of the bottom electrode extends from an edge of the planar portion of the bottom electrode, and further comprising a mold layer 23 on the planar portion of the bottom electrode and adjacent to the vertical portion of the bottom electrode, and wherein the middle interlayer insulating layer 48,49 covers the mold layer 23, and the contact hole exposes the mold layer 23 adjacent to the exposed vertical portion of the bottom electrode 22 (Figs 7-8,21, paragraphs 44-45; Figs 23-26). Re claim 10, wherein an etch stop layer 48 is between the bottom electrode 22 and the middle interlayer insulating layer 49 (Figs 18-26; paragraphs 58-60). Re claim 11, wherein a shield layer 42 covers a sidewall of the phase changeable material layer pattern 38 (Fig 25, paragraph 65). Re claim 12, wherein a plate electrode 40 on the top electrode 39, wherein the plate electrode 40 is electrically connected to the top electrode 39 (Figs 23,25; paragraph 63). Re claim 23, wherein the method further comprises: forming a middle interlayer insulating layer 49,48 on the bottom electrode 22, wherein the middle interlayer insulating layer defines a contact hole that exposes a part of the bottom electrode 22, and wherein forming a phase changeable material layer 38 on the bottom electrode 22 comprises forming the phase change material layer 38 in the contact hole, the phase changeable material layer 38 having a dented portion protruding toward the bottom electrode 22, and wherein forming a top electrode 39,40 on the phase changeable material 38 comprises forming a conductive layer 39,40 on the phase changeable material layer 38 including the dented portion of the phase changeable material layer 38 (Figs 18,23,25-26; paragraphs 57-66). Re claims 38,40,42,44, insofar as understood, wherein the top electrode the top electrode 39,40 having a tip that has a center along a length and width that is substantially aligned with a center of a facing surface of the vertical portion of the bottom electrode 22 (Figs 21-23,25,26A-26B for a thin tip portion of the top electrode deposited on a strip 57 and a thin tip portion 38a of the chalcogenic layer 38).

Allowable Subject Matter

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3. Claims 37,39,41,43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Amendment

4. Applicant's remarked filed December 08, 2005 have been fully considered but they are not persuasive.

It is noted Applicant's remarks about Figure 22 of Casagrande that the "...extended rectangular shape of the narrowed lower portion of electrode 40 consequently has a center that is offset from the facing surface of the vertical portion of the cup shaped electrodes 22...".

In response, Figure 22 is drawn to one embodiment where the top electrode extended across a plurality of cup shaped electrodes 22, thereby, the center of the top electrode is located (and offset) between these plurality of cup shaped electrodes 22.

However, as in other embodiments, first, in the case of marked alignment (Figs 16A-16B, paragraphs 0054-0055), there is just one contact area between the thin portion 38a and the cup shaped regions 22. Accordingly, the top electrode 39,40 (Figures Fig 21-23,25,26A-26B and Figures 16A-16B) having a tip that has a center along a length and width that is aligned with a center of a facing surface of the vertical portion of the bottom electrode due to having "just one contact area" between the thin portion 38a and the cup shaped region 22. Second, as shown in Figures 25,26A-26B, the top electrode 40 deposited over the portion 38a has a tip that has a center along a length and width that is approximately aligned with a center of a facing surface of the vertical portion of the bottom electrode. Although, as shown in Figures 26A-26B, the portion 38a has a rectangular shape, Casagrande also teaches (at paragraph 0057) that a rectangular shape also comprising the particular case of a square shape. Accordingly, a top electrode deposited on this portion 38a having square shape consequently has a tip that has a center along a length and width that is substantially aligned with a center of a facing surface of the vertical portion of the bottom electrode.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 9:00 Am to 5:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The central fax phone number is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).
Oacs-16


Michael Trinh
Primary Examiner